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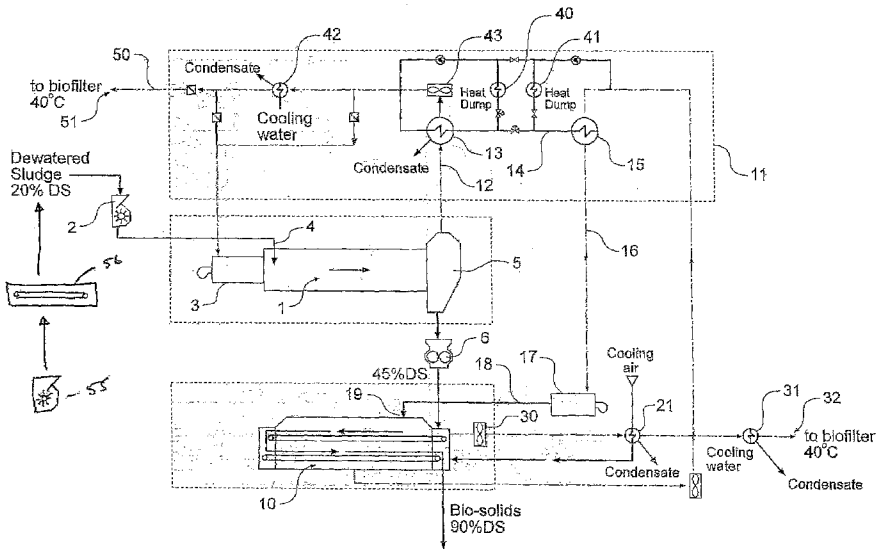
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Declaration under Rule 4.17:
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

[Continued on next page]

(54) **Title:** IMPROVEMENTS IN/OR RELATING TO A METHOD OF DRYING PASTY MATERIALS AND/OR APPARATUS FOR DRYING PASTY MATERIALS



(57) **Abstract:** The invention comprises method of and apparatus for drying pasty materials. The pasty materials are subjected to a first drying stage (1) at a first temperature, and then subjecting the partially dried pasty material are subjected to a second drying stage (10) at a second temperature. The second temperature is lower than the first temperature. The invention also envisages a method of drying and sterilising a pasty material comprising the steps of subjecting the pasty material to a first heat sterilisation process (1) and then a second heat drying process (10). The invention also envisages a method of drying pasty materials wherein the pasty material is broken into pieces (55) and partially dried (56) to form a crust at least partially over each piece prior to further processing of the pasty material.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Improvements in/or Relating to a Method of Drying Pasty Materials

and/or Apparatus for Drying Pasty Materials

TECHNICAL FIELD OF THE INVENTION

This invention relates to a method of drying pasty materials and/or apparatus for drying pasty materials such as sludges. Such sludges may comprise semi-solids, sludges and slurries consisting of treated or untreated sewage, or other biological waste material, or indeed other material containing evaporable liquids. Such liquids are usually water but are not exclusively so.

BACKGROUND ART

Sludges such as sewage sludges, for example, from municipal corporations, sludges from industrial plants such as pulp and paper plants, food processing plants, rendering plants, and waste treatment processes such as dissolved air flotation systems, anaerobic digestion, extended aeration and chemical beneficiation processes may contain a solids content from about 1% to 5%. Typically such sludges are subject to a dewatering process, for example, by mechanical filtering, centrifuging or pressing, to produce sludges that are largely free of free moisture. However the resulting sludge, which is left with essentially bound water, still has a substantial water content. In such sludges the dry solids content may be about 12% to 30%. In order to produce a stable product that is free of pathogens and which can be transported it is desirable to reduce the moisture content of such sludges to below 10%.

OBJECT OF THE INVENTION

It is therefore an object of the present invention to provide a method of drying pasty materials and/or apparatus for drying pasty materials which will go at least someway towards meeting the foregoing requirements in a simple yet effective manner or which will at least provide the public with a useful choice.

STATEMENT OF THE INVENTION

Accordingly, in one aspect the invention consists in a method of drying pasty materials comprising the steps of subjecting the pasty materials to a first drying stage at a first temperature, and then subjecting the partially dried pasty material to a second drying stage at a second temperature, the second temperature being lower than the first temperature.

Preferably the first drying stage is effected in a manner to minimise agglomeration of the pasty material.

Preferably the first drying stage is affected in a rotary dryer, the first drying stage being terminated before substantial agglomeration of the sludge occurs.

Preferably the rotary dryer is a drum dryer.

Preferably the second drying stage is affected on a non-agglomerating dryer.

Preferably said second drying stage is affected on a moving bed dryer.

Preferably the second temperature is selected to be below the explosion limits of the material as drying or when dried.

Preferably the first drying stage heats the core temperature of the pasty materials to at least 50°C.

Preferably the first drying stage heats the core temperature of the pasty material to at least 100°C.

Preferably the first drying stage heats the core temperature of the pasty materials to about 180°C.

Preferably the method further includes the step of comminuting the pasty material between the first drying stage and the second drying stage.

Preferably the method further includes the step of comminuting the pasty material prior to the first drying stage.

Preferably the method includes the further step of dividing the pasty material into pieces and partially drying the pieces prior to said first drying stage.

In a further aspect the invention consists in a method of drying and sterilising a pasty material comprising the steps of subjecting the pasty material to a first heat sterilisation process and then a second heat drying process.

Preferably the sterilisation process is commenced whilst the pasty material is relatively wet.

Preferably the moisture content is greater than 15% by weight.

Preferably the moisture content is in the range 70% to 88% by weight.

In a still further aspect the invention consists in apparatus for drying pasty materials comprising a first dryer operable at a first temperature, and a second dryer operating at a second temperature, the second temperature, being lower than the first temperature.

Preferably said first dryer comprises a single or multi pass dryer.

Preferably said second dryer consists of a single or multi pass dryer.

Preferably said first dryer comprises a rotary dryer.

Preferably said rotary dryer comprises a drum dryer.

Preferably said second dryer comprises a moving bed dryer.

Preferably said second temperature is below the explosion limits of material to be drying or dried on the dryer.

Preferably the first dryer includes a heater able to raise the core temperature of the pasty material to at least 100°C.

Preferably the first dryer includes a heater capable of raising the core temperature of the pasty materials to about 180°C.

Preferably said apparatus further includes a communiter between the first and second dryer.

Preferably said apparatus further includes a further communiter prior to the first dryer.

Preferably said apparatus includes a still further communiter to break the pasty material into pieces prior to the first dryer.

Preferably a pre-dryer is provided to at least partially dry the pasty material prior to the further communiter.

In a still further aspect the invention consists in a method of drying pasty materials wherein the pasty material is broken into pieces and partially dried to form a crust at least partially over each piece prior to further processing of the pasty material.

To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

One preferred form of the invention will now be described with reference to the accompanying drawing which is a diagrammatic representation of apparatus for drying pasty material according to one preferred form of the invention and illustrating a method of drying pasty material according to one preferred form of the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring to the drawings pasty material such as dewatered sludge having a dry solids content, for example about 20% DS (dry solids) by weight is input into a first dryer 1. If desired or necessary the dewatered sludge may be passed through a first communiter 2 prior to entering the first dryer. The communiter 2 typically breaks up lumps of material greater than 15mm to a size range of particles of 10mm to 20mm. Essentially the communiter 2 shreds the material to produce uniform discreet particulates for provision to the first dryer 1. Alternatively, comminuter 2 can be an extruder.

The first dryer which may be a single or multi pass dryer, is a dryer capable of being run at a first higher temperature and in the preferred form of the invention is a rotary dryer particularly a drum dryer. The dryer includes a heater 3 which is capable of raising the temperature of the dewatered sludge to a desired core temperature preferably at least 50°C, more preferably 100°C, and even more preferably about 180°C so that pathogens are quickly substantially eliminated by the heating process.

In the preferred form of rotary dryer 1 a single pass rotary drum drier is provided which is able to operate with air/feed product ratios that are lower than those of conventional rotary drum dryers. The dryer is designed with internal baffles and lifters and the drum is set at an optimum angle of tilt, to ensure the drying in the dryer is carried out in an energy efficient manner and such that heat loss in the exhaust gases are minimised. Such a dryer is available from the applicant and is known as a Flo-Dry Rotary Dryer.

In the first dryer 1 the particulates are dried to 40% to 60% dry solids by weight in the first dryer 1 so that the product does not substantially agglomerate or ball up into lumps. Any lumps formed in the first dryer 1 will be usually no more than 20mm in diameter. The energy input to first dryer 1 can be by a direct fire burner using such fuels as Natural Gas, LPG, Petroleum Dryer base liquid fuel, bio-gas from digesters, hot exhaust gases from engines producing electricity or from pulverized fuel burners using solid fuel including the final dried sludge output from the present invention.

The inlet temperature of the hot air and combusting gases are desirably in the range of 300°C to 800°C which temperatures are substantially higher than temperatures used in prior art dryers. Such temperatures not only reduce the amount of air used in the drying process but also sterilise the sludge to meet the requirements of USEPA 503A standards or better.

In the preferred form of the invention the product on entering the feeding in end 4 of the first dryer 1 is heated by the hot gases to rapidly reach a core temperature in the range of 50°C to 180°C (being at least 100°C and preferably about 180°C) and these temperatures are held for a sufficient time to be equivalent of the conventional sterilisation process which requires holding the final dried product at 80°C to 90°C for several minutes and to exceed the current pathogen

reduction requirements of the USDA, E.U., and the New Zealand Ministry of the Environment requirements.

The high inlet temperature to the first dryer enables the core temperature of the product to be rapidly reached. The time needed for substantially complete killing of pathogens is in the order of seconds when the core temperature is in the range of 100°C to 180°C. One reason for the rapid increase in core temperature is that the sterilisation step is carried out at the beginning of the procedure when the moisture content of the sludge is high, for example, around 70% to 88%. This high moisture content has the effect of increasing the heat transfer characteristics of thermal conductivity, specific heat, and the overall heat transfer into the core of the product enabling the product to be heated up to, in the preferred embodiment, 180°C without damaging the organic heat labile properties of the sludge and also without risk of explosion.

At the feed end 4 of the first dryer 1 the high moisture content substantially prevents dust formation and over heating of the product as the heat applied to the product is substantially utilised in evaporating the water from the sludge.

In prior art constructions heat sterilisation is applied at the end of the process when the moisture content is typically below 15% by weight and may be as low as 10% by weight. In these circumstances heating even to 80°C at this low moisture content can produce dust with an attendant risk of explosion. The use of the high inlet temperature in first dryer 1 means that the amount of air used in the first dryer 1 is reduced significantly which reduces the absolute oxygen content inside the first dryer 1 again leading to less explosive conditions and furthermore the reduced air reduces the size of the drying and associated equipment such as ducts, fans, and the heat exchange equipment.

Product exiting the outlet end 5 of the first dryer 1 may be fed to a further comminuter 6 which again breaks up any large lumps of particulates to a typical size of 5mm to 15mm. One or two slowly rotating shafts (for example 3 to 30 rpm) on which cutters or blades are mounted may be provided in the communiter 6. For some sludges the comminuter 6 may be replaced by an extruder which would produce uniform strings of material which could be cut to a selected length of product. Typically the particle size in such a case would be around 2mm to 8mm in diameter and 5mm to 20mm long.

Accordingly, the product discharge from the comminuter 6 is substantially uniformly sized.

The output product from the communiter 6 is provided to a second dryer 10 which again may be single or multipass. The second dryer 10 operates at a lower temperature than the first dryer and the second dryer 10 is also of a non agglomerating type of which a typical example is a belt dryer. The belt dryer may be heated by hot air, the air being in the range of 30°C to 150°C and the second dryer 10 is of sufficient length so that the sludge at the output of the second dryer 10 has a dry solids content desirably of 90% to 95%. The temperature in the second dryer is selected to be sufficiently low to exclude or at least minimise the risk of dust explosion.

In a preferred form of the invention the heat energy for the second dryer 10 is supplied from the heat content in the evaporated water and gases from the dryer 1 which can be condensed and/or cooled in a heat exchanger system 11 to produce hot water at around 35°C to 95°C. If desired the heat content in the evaporated water and gases from the dryer 1 may be heat exchanged with air to produce the hot air necessary for the second dryer 10. Accordingly, gases at about 100°C are provided at line 12 where it passes through a heat exchange of 13 to provide water at, for example about 80°C at 14. The heat exchanger 15 provides gases at say 70°C at 16 and if necessary a supplementary or makeup air heater 17 is provided to provide gases at around 90°C at 18 to be input to dryer 10 at 19. The product discharged from second dryer 10 is cooled to around 40°C to 50°C in a cooling section within or outside the second dryer 10. Cooling air from the atmosphere at, for example 5°C to 30°C may be heat exchanged in an air heat exchanger 21 and used to cool the final dry product.

This use of fans, condensers and heat pumps allows heat energy to be conserved. An ID fan 30 may be provided to enable humid exhaust air from the second dryer 10 which is around 40°C to 105°C to be passed through an air/water condenser 31, and the cooled dehumidified air is finally treated in a bio-filter, or any other odour treating device if desired, indicated at 32 so as to reduce any odour in the discharged gases.

Part of the exhaust gas from second dryer 10 is heated in the air/water heat exchanger 15 and reused in the second dryer 10. The exhaust vapour and gases from the dryer 1 are passed through a condenser 13 which is an air/water heat exchanger and the dehumidified air is used as an air input to the first dryer 1. Other heat exchange devices such as heat pumps 40 and 41, and

heat exchanger 42, as well as ID fan 43 are used to balance the thermal recovery system indicated generally at 11. The final exhaust from first dryer 1 at 50, is sent to a bio-filter indicated at 51.

For some sludges it can be advantageous to pre-break the wet sludge from the dewatering process into discrete particles of about 25 to 50mm in a communiter 55.

This can then be pre-heated in heater 56 which could be a conveying belt dryer utilising recovered heat from the downstream drying process. Other forms of heating such as infra-red, microwave, or electrical. The aim is to heat the outside of the pre-broken particles to form a crust to minimise or prevent balling up of difficult sludges, which could otherwise occur in the communiter 2 or dryer 1. This minimises the creation of dust which may be as low as 1% of the weight of the input wet sludge. This pre-heating forms a crust over at least part, and preferably all, of the surface of each sludge piece.

Thus it can be seen that a method for drying pasty materials and/or apparatus for drying pasty materials is provided which at least in the preferred form of the invention has the advantage that the pasty materials may be dried in an efficient manner to reduce energy consumption, to minimise the risk of agglomeration of the pasty materials during drying so as to minimise maintenance requirements and which also minimises the risk of, in particular, dust explosion. The construction is space and energy efficient whilst maintaining efficiency for maintenance.

As the dried product does not need to be recycled there is a reduction in energy requirements and no recycle pathway, of product being dried, is required, thereby allowing a reduction in the "footprint" of the operations.

Energy requirements can be minimised by using heat exhausted from the first drying stage. It is believed that significant thermal and electrical energy consumption reduction can be achieved when compared to existing systems.

Providing high heat input at the beginning of the process enables relevant standards to be met.

The process also produces a granular substantially dust free product.

WHAT WE CLAIM IS:

1. A method of drying pasty materials comprising the steps of subjecting the pasty materials to a first drying stage at a first temperature, and then subjecting the partially dried pasty material to a second drying stage at a second temperature, the second temperature being lower than the first temperature.

2. A method as claimed in claim 1 wherein the first drying stage is effected in a manner to minimise agglomeration of the pasty material.

3. A method as claimed in either claim 1 or claim 2 wherein the first drying stage is affected in a rotary dryer, the first drying stage being terminated before substantial agglomeration of the sludge occurs.

4. A method as claimed in claim 3 wherein the rotary dryer is a drum dryer.

5. A method as claimed in any one of the preceding claims wherein the second drying stage is affected on a non-agglomerating dryer.

6. A method as claimed in claim 5 wherein said second drying stage is affected on a moving bed dryer.

7. A method as claimed in any one of the preceding claims wherein the second temperature is selected to be below the explosion limits of the material as drying or when dried.

8. A method as claimed in any one of the preceding claims wherein the first drying stage heats the core temperature of the pasty materials to at least 50°C.

9. A method as claimed in claim 8 wherein the first drying stage heats the core temperature of the pasty material to at least 100°C.

10. A method as claimed in claim 9 wherein the first drying stage heats the core temperature of the pasty materials to about 180°C.

11. A method as claimed in any one of the preceding claims further including the step of comminuting the pasty material between the first drying stage and the second drying stage.

12. A method as claimed in any one of the preceding claims further including the step of comminuting the pasty material prior to the first drying stage.

13. A method as claimed in any one of the preceding claims further including the further step of dividing the pasty material into pieces and partially drying the pieces prior to said first drying stage.

14. A method of drying and sterilising a pasty material comprising the steps of subjecting the pasty material to a first heat sterilisation process and then a second heat drying process.

15. A method as claimed in claim 14 wherein the sterilisation process is commenced whilst the pasty material is relatively wet.

16. A method as claimed in claim 15 wherein the moisture content is greater than 15% by weight.

17. A method as claimed in claim 16 wherein the moisture content is in the range 70% to 88% by weight.

18. Apparatus for drying pasty materials comprising a first dryer operable at a first temperature, and a second dryer operating at a second temperature, the second temperature, being lower than the first temperature.

19. Apparatus as claimed in claim 18 wherein said first dryer comprises a single or multi pass dryer.

20. Apparatus as claimed in either one of claims 18 and 19 wherein said second dryer consists of a single or multi pass dryer.

21. Apparatus as claimed in any one of claims 18 to 20 wherein said first dryer comprises a rotary dryer.

22. Apparatus as claimed in any one of claims 18 to 21 wherein said rotary dryer comprises a drum dryer.

23. Apparatus as claimed in any one of claims 18 to 22 wherein said second dryer comprises a moving bed dryer.

24. Apparatus as claimed in any one of claims 18 to 23 wherein said second temperature is below the explosion limits of material to be drying or dried on the dryer.

25. Apparatus as claimed in any one of claims 18 to 24 wherein the first dryer includes a heater able to raise the core temperature of the pasty material to at least 100°C.

26. Apparatus as claimed in any one of claims 18 to 25 wherein the first dryer includes a heater capable of raising the core temperature of the pasty materials to about 180°C.

27. Apparatus as claimed in any one of claims 18 to 26 wherein said apparatus further includes a communiter between the first and second dryer.

28. Apparatus as claimed in any one of claims 18 to 27 wherein said apparatus further includes a further communiter prior to the first dryer.

29. Apparatus as claimed in claim 28 wherein said apparatus includes a still further communiter to break the pasty material into pieces prior to the further communiter.

30. Apparatus as claimed in either one of claims 28 and 29 wherein a pre-dryer is provided to at least partially dry the pasty material prior to the further communiter.

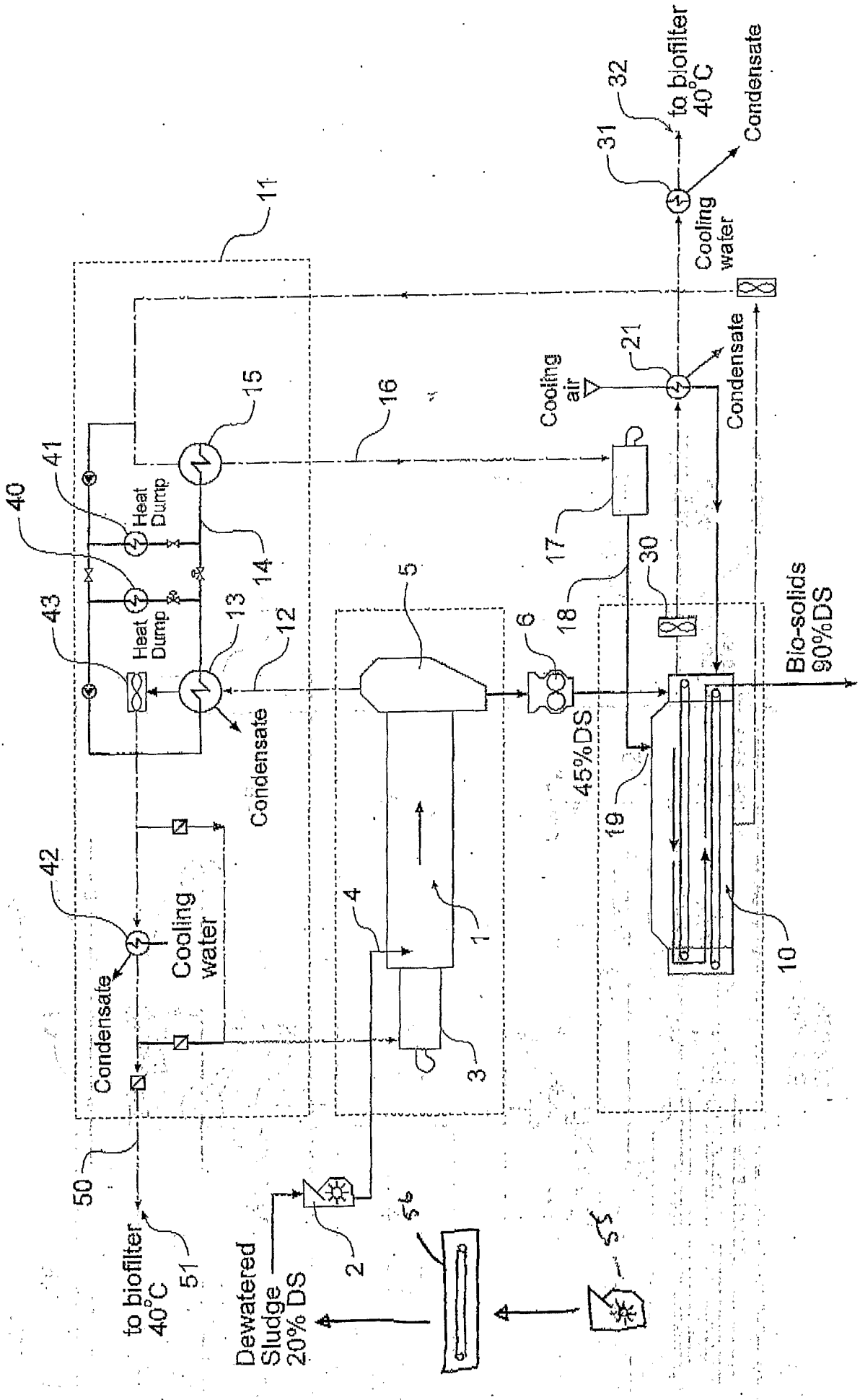
31. A method of drying pasty materials wherein the pasty material is broken into pieces and partially dried to form a crust at least partially over each piece prior to further processing of the pasty material.

32. A method as claimed in claim 1 and substantially as herein described with reference to the accompanying drawing.

33. A method as claimed in claim 14 and substantially as herein described with reference to the accompanying drawing.

34. Apparatus as claimed in claim 18 and substantially as herein described with reference to the accompanying drawing.

35. A method as claimed in claim 31 and substantially as herein described with reference to the accompanying drawing.


11
40
41
Heat Dump
43
Heat Dump
15
16
14
13
12
Condensate
42
Cooling water
Condensate
50
51
to biofilter 40°C
Dewatered Sludge 20% DS
2
4
5
1
3
6
45%DS
17
18
30
19
10
Bio-solids 90%DS
Cooling air
21
Condensate
31
32
to biofilter 40°C
Condensate
Cooling water
55
56

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2006/000187

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

C02F 11/12 (2006.01) ***F26B 3/00*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
USPTO, ESP@CE, WPAT: pasty, sludge, slurry, heat, temperature

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	DE 19825597 A1 (KLEIN UMWELTTECHNIK GMBH ALB) 16 December 1999	
X	Abstract, claims	1,2,18-20
Y		3-6,21-23
	EP 0559012 A1 (ENNING H J) 08 September 1993	
X	Abstract, claims	1,2,18-20
Y		3-6,21-23
	DE 3312145 A1 (WEFELS, F G D) 04 October 1984	
X	Abstract, claims	1,2,18-20
Y		3-6,21-23
	US 5305533 A (ALEXANDER ET AL) 26 April 1994	
Y	Whole document	3-6,21-23
	Note: For "Y" indications US 5305533 can be combined with any other document.	

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 December 2006	08 DEC 2006
Name and mailing address of the ISA/AU	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2006/000187

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Group I: Claims 1-13, 18-30, 32, 34
Group II: Claims 14-17, 33
Group III: Claims 31, 35

See extra sheet for details

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-13, 18-30, 32, 34

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Supplemental Box
(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: III (Lack of Unity)

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

In assessing whether there is more than one invention claimed, I have given consideration to those features which can be considered to potentially distinguish the claimed combination of features from the prior art. Where different claims have different distinguishing features they define different inventions.

This International Searching Authority has found that there are different inventions as follows:

- Claims 1-13, 18-30, 32, 34 are directed to a method of drying pasty materials comprising the steps of subjecting the pasty materials to a first drying stage at a first temperature and then subjecting the partially dried pasty material to a second drying stage at a second temperature, the second temperature being lower than the first temperature. It is considered that drying the partially dried pasty material at a second temperature which is lower than the first temperature comprises a first distinguishing feature.

- Claims 14-17, 33 are directed to a method of drying and sterilising a pasty material comprising the steps of subjecting the pasty material to a first heat sterilisation process and then a second heat drying process. It is considered that the steps of heat sterilisation and heat drying processes comprise a second distinguishing feature.

- Claims 31, 35 are directed to a method of drying pasty materials wherein the pasty material is broken into pieces and partially dried to form a crust at least partially over each piece prior to further processing of the pasty material. It is considered that the method of breaking the pasty materials into pieces and partially drying them to form a crust at least partially over each piece prior to further processing comprises a third distinguishing feature.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

Each of the abovementioned groups of claims has a different distinguishing feature and they do not share any feature which could satisfy the requirement for being a special technical feature. Because there is no common special technical feature it follows that there is no technical relationship between the identified inventions. Therefore the claims do not satisfy the requirement of unity of invention *a priori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/NZ2006/000187

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member				
DE	19825597				
EP	0559012	DE	4215530	DE	4215933
DE	3312145				
US	5305533				

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX